IN-SITU INVESTIGATION OF ATMOSPHERIC ELECTRICITY AND ACOUSTICS: LESSONS LEARNED FROM THE SUCCESSFUL FLIGHT OF THE HUYGENS ATMOSPHERIC STRUCTURE INSTRUMENT PERMITTIVITY, WAVE AND ALTIMETRY EXPERIMENT

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The Permittivity, Wave and Altimetry (PWA) experiment, a sub-unit of the Huygens Atmospheric Structure Instrument (HASI), was designed to investigate atmospheric conductivity, electric fields, lightning activity, and acoustic phenomena in the atmosphere and on the surface of Saturn's biggest moon, Titan. The processing of Huygens Radar Altimeter data was implemented as an add-on in order to support scientific exploitation of the data delivered by this probe system. The performance of the instrument, as observed in terrestrial tests and during the successful mission, allows identifying a number of possible improvements in both instrument design and data processing which will be beneficial for future planetary probe missions employing similar types of sensors.

The basic design of the instrument is introduced. The individual sensors, their characteristics and measurement capabilities are presented. Processing of data by the PWA signal processor is explained. Data from terrestrial tests as well as data from the Huygens descent on Titan are shown. Instrument design features and their impact on the scientific investigations are presented, and improvements of the sensor design are suggested. The influence of probe motion and environmental effects is discussed. The importance of additional data sources for the interpretation of the science data is explained, and new and improved instrument features for future atmospheric probes are suggested.